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Post-Cerro Grande Fire Environmental Sampling Data: Upper Los Alamos Canyon Alluvial Groundwater Samples Collected in June 2000

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Acronyms

DOE	US Department of Energy
EPA	US Environmental Protection Agency
ER	environmental restoration
MCL	maximum contaminant level
NMED	New Mexico Environment Department
WQCC	Water Quality Control Commission

1.0 INTRODUCTION

The Los Alamos National Laboratory's (the Laboratory's) Environmental Restoration (ER) Project collected alluvial groundwater samples in upper Los Alamos Canyon from June 21 to June 27, 2000 (after the Cerro Grande fire). This report summarizes the analytical results of those sampling efforts.

Sampling was conducted before the summer monsoon season and before significant postfire flooding occurred in Los Alamos Canyon. This sampling provided baseline data for later comparison with data from samples collected during the monsoon season, because the chemistry of the floodwater could affect groundwater quality in the canyon. For more information, see the conceptual model at http://erproject.lanl.gov/Fire/Data/datahome.html#CE_Model. These groundwater sample locations were selected to represent potential spatial variability in water quality in Los Alamos Canyon and were chosen from existing alluvial groundwater monitoring wells.

2.0 SAMPLING AND ANALYSIS

Sampling

A total of 11 alluvial groundwater samples were collected from five alluvial wells located in upper Los Alamos Canyon. The well locations are shown on Figure 2.0-1. Table 2.0-1 provides well locations, sampling dates, and numbers of samples collected for each well.

Table 2.0-1
Description of Upper Los Alamos Canyon Alluvial Wells Sampled in June 2000

Well	Description of Location	Date Sampled	Number of Samples Collected
LAO-B	Approximately 1 mi east of Los Alamos Reservoir	6/21/00	1 filtered, 2 nonfiltered
LAO-0.3	Approximately 3 mi east of Los Alamos Reservoir	6/22/00	1 filtered, 1 nonfiltered
LAO-0.6	Approximately 2600 ft east of LAO-0.3	6/21/00	1 filtered, 1 nonfiltered
LAO-0.91	Approximately 4000 ft east of LAO-0.3	6/22/00	1 filtered, 1 nonfiltered
LAO-1.6(g)	Approximately 400 ft west of the confluence of Los Alamos Canyon and DP Canyon	6/23/00	1 filtered, 1 nonfiltered

Both filtered and nonfiltered water samples were collected to characterize the difference in results caused by the presence of suspended solids. Filtered samples are used to evaluate the dissolved chemicals in samples. Nonfiltered samples are used to evaluate chemicals associated with the suspended sediment in addition to the dissolved chemicals. Filtered samples were prepared in the field by filtration through a 0.45-micron filter. All water samples were analyzed by analytical laboratories that are approved by the ER Project and that are external to the Laboratory.

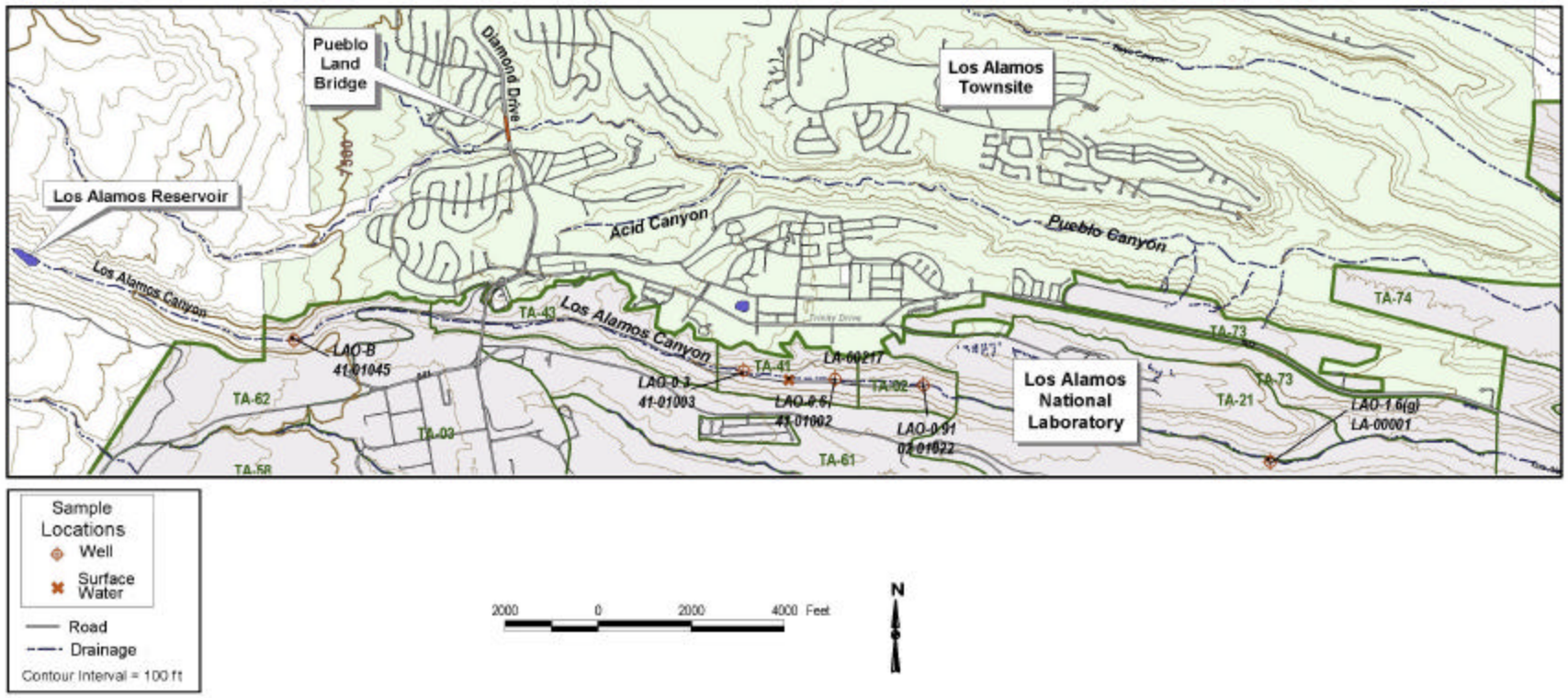

Figure 2.0-1. Post-Cerro Grande fire alluvial groundwater monitoring well and surface water sampling locations in Upper Los Alamos Canyon

The first major storm event after the Cerro Grande fire occurred on June 2, 2000. Although this event did not produce a flood in Los Alamos Canyon, some increased surface water flow that contained ash and fire-fighting chemicals was generated as the Los Alamos reservoir (located higher in the watershed) was drained. Therefore, ash-related chemicals and fire-fighting chemicals may be present in these groundwater samples. Because some chemicals or chemical concentrations not related to Laboratory operations have been identified in ash and flood-transported ash (muck), the results should be evaluated in that context. Data summaries for baseline ash and muck samples collected by the ER Project in June 2000 are provided at http://erproject.lanl.gov/Fire/Data/ash-muck.html.

Analysis

All nonfiltered and filtered samples were analyzed for the following inorganic chemicals and radionuclides: 23 trace metals, uranium, ammonia, nitrite and nitrate, total phosphorus, americium-241, isotopic plutonium (plutonium-238 and plutonium-239), isotopic uranium (uranium-234, uranium-235, and uranium-238), and strontium-90.

Only filtered samples were analyzed for the following chemicals: bicarbonate, carbonate, chloride, fluoride, sulfate, and total dissolved solids.

Only nonfiltered samples were analyzed for the following chemicals: perchlorate, total cyanide, gamma-emitting radionuclides, and tritium.

One nonfiltered sample collected from well LAO-B was analyzed for dioxins and furans, and one filtered sample from LAO-B was analyzed for humic substances.

3.0 DATA SUMMARY TABLES

The inorganic and radionuclide chemical data for the water samples are summarized in two separate tables (Tables 3.0-1 and 3.0-2, respectively). Each table lists the chemical analyte, the number of samples analyzed, the number of detected results, and the minimum, mean, and maximum value for the detected results.

The summary tables compare the analytical results with US Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) drinking water maximum contaminant levels (MCLs). The current EPA drinking water MCLs, along with the supporting information, are available at http://www.epa.gov/safewater/mcl.html. The NMED MCLs are available under “Environmental Protection Regulations, Regulations by Subject, Drinking Water–20NMAC7.1” at http://www.nmenv.state.nm.us/.

The drinking water MCLs are used only as screening levels for the purposes of reviewing the alluvial groundwater sampling results. An exceedance of its screening level by a chemical does not necessarily mean that immediate action is necessary; an exceedance means only that further evaluation should be undertaken. That evaluation may include additional sample collection leading to a risk assessment, in order to accurately assess the potential risk from exposure.

For radionuclides that do not have a drinking water MCL, the sample results are compared with screening levels that are 4% of the derived concentration guide value provided in DOE Order 5400.5, “Radiation Protection of the Public and Environment.” The screening levels represent a dose limit of 4 millirem per year from the ingestion of water, consistent with the NMED drinking water regulations (20NMAC7.1). DOE Order 5400.5 is available at http://tis.eh.doe.gov/oepa/guidance/risk/54005.pdf.

Table 3.0-1
Upper Los Alamos Canyon Alluvial Groundwater Samples, June 2000: Data Summary for Inorganics

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL[b] (µg/L)	Frequency of Detects >MCL	NMED[a] Groundwater Standard[c] (µg/L)	Frequency of Detects >NMED Groundwater Standard
Aluminum	F[d]	5	4	33.4	106	300	50	2/5	5000	0/5
Aluminum	NF[e]	4	4	116	817	1900	—[f]	—	—	—
Ammonia (expressed as N)	F	4	1	240	240	240	—	—	—	—
Ammonia (expressed as N)	NF	4	1	130	130	130	—	—	—	—
Antimony	F	5	0	—	—	—	6	0/5	—	—
Antimony	NF	4	1	0.84	0.84	0.84	—	—	—	—
Arsenic	F	5	5	0.2	0.8	1.8	50	0/5	100	0/5
Arsenic	NF	4	4	0.3	0.9	1.7	—	—	—	—
Barium	F	5	5	22	53.5	77.6	2000	0/5	1000	0/5
Barium	NF	4	4	24	69.6	120	—	—	—	—
Beryllium	F	5	1	0.015	0.015	0.015	4	0/5	—	—
Beryllium	NF	4	2	0.02	0.071	0.121	—	—	—	—
Bicarbonate	F	5	5	42000	63000	76000	—	—	—	—
Cadmium	F	5	0	—	—	—	5	0/5	10	0/5
Cadmium	NF	4	0	—	—	—	—	—	—	—
Calcium	F	5	5	8900	18040	28000	—	—	—	—
Calcium	NF	4	4	9300	19450	28000	—	—	—	—
Carbonate	F	5	0	—	—	—	—	—	—	—
Chloride	F	5	5	6200	50440	89000	250000	0/5	250000	0/5
Chromium	F	5	3	2.7	6.1	12.2	100	0/5	50	0/5
Chromium	NF	4	2	11.8	17.1	22.3	—	—	—	—

Table 3.0-1 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL (µg/L)	Frequency of Detects >MCL	NMED Groundwater Standard (µg/L)	Frequency of Detects >NMED Groundwater Standard
Cobalt	F	5	0	—	—	—	—	—	50	0/5
Cobalt	NF	4	2	0.71	1.47	2.22	—	—	—	—
Copper	F	5	0	—	—	—	1300	0/5	1000	0/5
Copper	NF	4	1	1.4	1.4	1.4	—	—	—	—
Cyanide (total)	NF	5	0	—	—	—	—	—	—	—
Fluoride	F	5	4	130	235	400	4000	0/5	1600	0/5
Iron	F	5	4	8.2	88	200	300	0/5	1000	0/5
Iron	NF	4	4	84.9	596	1400	—	—	—	—
Lead	F	5	3	0.138	0.264	0.459	15	0/5	50	0/5
Lead	NF	4	3	0.125	0.948	1.36	—	—	—	—
Magnesium	F	5	5	2700	4282	5200	—	—	—	—
Magnesium	NF	4	4	2700	4355	5450	—	—	—	—
Manganese	F	5	2	23	56.2	89.3	50	1/5	200	0/5
Manganese	NF	4	4	2.11	246	920	—	—	—	—
Mercury	F	5	0	—	—	—	2	0/5	—	—
Mercury	NF	4	0	—	—	—	—	—	2	0/4
Nickel	F	5	1	0.82	0.82	0.82	100	0/5	200	0/5
Nickel	NF	4	1	48.1	48.1	48.1	—	—	—	—
Nitrate + nitrite (expressed as N)	F	5	4	55	419	820	10000	0/5	—	—
Nitrate + nitrite (expressed as N)	NF	4	2	150	500	850	—	—	—	—
Perchlorate	NF	4	0	—	—	—	—	—	—	—
Phosphorus (total)	F	5	0	—	—	—	—	—	—	—
Phosphorus (total)	NF	4	1	130	130	130	—	—	—	—
Potassium	F	5	5	2200	3556	4600	—	—	—	—

Table 3.0-1 (continued)

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (µg/L)	Mean of Detects (µg/L)	Maximum of Detects (µg/L)	Drinking Water MCL (µg/L)	Frequency of Detects >MCL	NMED Groundwater Standard (µg/L)	Frequency of Detects >NMED Groundwater Standard
Potassium	NF	4	4	2300	3635	4800	—	—	—	—
Selenium	F	5	5	0.2	1.9	3.8	50	0/5	50	0/5
Selenium	NF	4	3	2.2	2.3	2.4	—	—	—	—
Silver	F	5	1	0.02	0.02	0.02	100	0/5	50	0/5
Silver	NF	4	3	0.05	0.14	0.32	—	—	—	—
Sodium	F	5	5	7900	30200	46000	—	—	—	—
Sodium	NF	4	4	8100	33750	50900	—	—	—	—
Sulfate	F	5	5	4300	10620	14000	250000	0/5	600000	0/5
Thallium	F	5	1	0.43	0.43	0.43	2	0/5	—	—
Thallium	NF	4	2	0.033	0.23	0.427	—	—	—	—
Total dissolved solids	F	4	4	130000	242500	400000	500000	0/4	1000000	0/4
Uranium	F	5	3	0.034	0.166	0.367	—	—	5000	0/5
Uranium	NF	4	3	0.11	0.221	0.412	—	—	—	—
Vanadium	F	5	5	0.74	2.0	4.4	—	—	—	—
Vanadium	NF	4	4	0.96	3.0	4.3	—	—	—	—
Zinc	F	5	1	21	21	21	5000	0/5	10000	0/5
Zinc	NF	4	0	—	—	—	—	—	—	—

[a] NMED = New Mexico Environment Department.

[b] MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

[c] State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

[d] F = Filtered.

[e] NF = Nonfiltered.

[f] Value is not available or not applicable.

Table 3.0-2
Upper Los Alamos Canyon Alluvial Groundwater Samples, June 2000: Data Summary for Radionuclides

Analyte	Field Preparation	Number of Analyses	Number of Detects	Minimum of Detects (pCi/L)	Mean of Detects (pCi/L)	Maximum of Detects (pCi/L)	Drinking Water MCL[b] (pCi/L)	Frequency of Detects >MCL	DCG[a] Screening Level (pCi/L)	Frequency of Detects >DCG Screening Level
Americium-241	F[c]	5	0	—[d]	—	—	15[e]	0/5	1.2	0/5
Americium-241	NF[f]	5	0	—	—	—	—	—	—	—
Cesium-134	NF	5	0	—	—	—	—	—	80	—
Cesium-137	NF	5	0	—	—	—	—	—	120	0/5
Cobalt-60	NF	5	0	—	—	—	—	—	200	0/5
Europium-152	NF	5	0	—	—	—	—	—	800	0/5
Plutonium-238	F	5	0	—	—	—	15[e]	0/5	1.6	0/5
Plutonium-238	NF	4	0	—	—	—	—	—	—	—
Plutonium-239	F	5	0	—	—	—	15[e]	0/5	1.2	0/5
Plutonium-239	NF	4	2	0.062	0.1315	0.201	—	—	—	—
Ruthenium-106	NF	5	0	—	—	—	—	—	240	0/5
Sodium-22	NF	5	0	—	—	—	—	—	400	0/5
Strontium-90	F	5	1	1.74	1.74	1.74	8	0/5	—	—
Strontium-90	NF	4	1	1.94	1.94	1.94	—	—	—	—
Tritium	NF	5	5	50	195	549	20000	0/5	—	—
Uranium-234	F	5	2	0.065	0.155	0.245	—	—	20	0/5
Uranium-234	NF	4	1	0.193	0.193	0.193	—	—	—	—
Uranium-235	F	5	0	—	—	—	—	—	24	0/5
Uranium-235	NF	5	0	—	—	—	—	—	—	—
Uranium-238	F	5	1	0.126	0.126	0.126	—	—	24	0/5
Uranium-238	NF	4	2	0.13	0.134	0.138	—	—	—	—

[a] DCG = Derived concentration guide. DCG screening levels are based on the ingested water DCGs published in DOE Order 5400.5, *Radiation Protection of the Public and Environment* (January 1993). The DCG screening levels presented in this table are calculated as 4% of the ingested water DCGs and represent a dose limit of 4 millirem per year from the ingestion of water.

[b] MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

[c] F = Filtered.

[d] Value is not available or not applicable.

[e] Based on an MCL of 15 pCi/L for gross alpha particle activity (including radium-226 but excluding radon and uranium).

[f] NF = Nonfiltered.

The filtered and nonfiltered results for inorganic parameters are also compared with NMED Water Quality Control Commission (WQCC) groundwater standards. These standards apply only to filtered samples, with the exception of the mercury standard, which applies to nonfiltered samples. The WQCC groundwater standards are available under "Environmental Protection Regulations, Regulations by Subject, Ground and Surface Water Protection, 20NMAC6.2," at http://www.nmenv.state.nm.us/.

The results for humic substances for the sample collected from well LAO-B are presented in Table 3.0-3. No compounds were detected in the LAO-B sample that was analyzed for dioxins and furans.

Table 3.0-3
Alluvial Well LAO-B June 2000 Sample: Humic Substances Results

Analyte	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)
Humic Substances, Hydrophilic acids	F[a]	1	1	900
Humic Substances, Hydrophilic bases	F	1	0	—[b]
Humic Substances, Hydrophilic neutrals	F	1	0	—
Humic Substances, Hydrophilic total	F	1	1	900
Humic Substances, Hydrophobic acids	F	1	1	400
Humic Substances, Hydrophobic bases	F	1	0	—
Humic Substances, Hydrophobic neutrals	F	1	1	400
Humic Substances, Hydrophobic total	F	1	1	800

[a] F = Filtered.

[b] Value is not available or not applicable.

4.0 REFERENCES

DOE (US Department of Energy) Order 5400.5, "Radiation Protection of the Public and Environment," January 1993, http//tis.eh.doe.gov/oepa/guidance/risk/54005.pdf.

EPA (US Environmental Protection Agency), National Primary Drinking Water Standards, http://www.epa.gov/safewater/mcl.html.

ER Project (Environmental Restoration Project), http://erproject.lanl.gov/Fire/Data/ash-muck.html

NMED (New Mexico Environment Department), Environmental Protection Regulations, Regulations by Subject, Drinking Water–20NMAC7.1, http://www.nmenv.state.nm.us/.

NMED (New Mexico Environment Department), Environmental Protection Regulations, Regulations by Subject, Ground and Surface Water Protection–20NMAC6.2, http://www.nmenv.state.nm.us/.